

DESCRIPTION

ELECTRIC CLEANER

Technical Field

[0001] The present invention relates to an electric vacuum cleaner comprising a separating section for separating dust that is sucked therein with air by driving an electric blower.

Background Art

[0002] Conventionally, such kinds of electric vacuum cleaners are equipped with a vacuum cleaner main body with an electric blower housed therein. In the vacuum cleaner main body, there is disposed a separating section communicating with a main body suction port that is formed in an opening manner in the vacuum cleaner main body. The separating section is adapted to cyclone-separate dust that is sucked therein with air through the main body suction port by driving the electric blower in accordance with the specific gravity or size thereof. Also, on the downstream side of the separating section, there is provided an opening portion communicating with an air passage that communicates with the suction side of the electric blower, the opening portion being provided with a filter section. Then, the separating section separates dust that is sucked therein with air via the main body suction port by

driving the electric blower in accordance with the specific gravity or size thereof, and the separated dust is partially trapped in the filter section when passing through the opening portion with the air so that the air with the dust being partially removed flows into the electric blower (refer to Patent Document 1, for example).

Patent Document 1: Japanese Examined Utility Model Publication No. 47-9805 (page 1 to 2 and Fig.1)

Disclosure of the Invention

Problem to be Solved by the Invention

[0003] In the above-described electric vacuum cleaner, in which coarse dust and fine dust are collected separately in such a way as inertial separation, since it is often the case that the filter section, etc., is clogged with the fine dust, it is necessary to ensure an increased filtering area.

[0004] It is however necessary to increase the cross-sectional area of the separating section or the air passage to increase the filtering area, resulting in a problem in that it is not easy to ensure an increased filtering area without increasing the size of the vacuum cleaner main body.

[0005] The present invention has been made in consideration of the above-described problem, and an object thereof is to provide an electric vacuum cleaner in which it

is possible to ensure an increased area of a first filter while saving space.

Means for Solving the Problem

[0006] The present invention includes: a separating section for separating dust that is sucked therein with air through an intake port by driving an electric blower into coarse dust and fine dust; a coarse dust air passage into which the coarse dust flows with part of the air; a fine dust air passage provided parallel with the coarse dust air passage into which the fine dust flows with the rest of the air; a partition wall positioned between the coarse dust air passage and the fine dust air passage; a first filter provided in an opening portion that is opened in the partition wall along the coarse dust air passage; and a second filter provided on the downstream side of the fine dust air passage.

[0007] The present invention also includes: a separating section including a separating main body part that is formed into an approximately cylindrical shape and communicates with an intake port and an auxiliary opening bored on the periphery of the separating main body part to separate dust that is sucked therein with air through the intake port by driving an electric blower into coarse dust and fine dust; a coarse dust air passage into which the coarse dust flows with part of the air; and a

fine dust air passage provided parallel with the coarse dust air passage into which the fine dust flows with the rest of the air.

[0008] The present invention further includes: a separating section for separating dust that is sucked therein with air through an intake port by driving an electric blower into coarse dust and fine dust; a main communication passage into which the coarse dust flows with part of the air; an auxiliary air passage provided parallel with the main communication passage into which the fine dust flows with the rest of the air; a partition wall positioned between the main communication passage and the auxiliary air passage; a first filter provided in an opening portion that is opened in the partition wall along the main communication passage; and a second filter provided on the downstream side of the auxiliary communication passage.

Effect of the Invention

[0009] In accordance with the present invention, in the partition wall positioned between the coarse dust air passage into which coarse dust separated in the separating section flows with part of the air and the fine dust air passage into which fine dust flows with the rest of the air, there is opened the opening portion along the coarse dust air passage, and the

opening portion is provided with the first filter, whereby it is possible to ensure an increased area of the first filter while saving space.

[0010] Also, in accordance with the present invention, the separating section comprises: the coarse dust air passage into which coarse dust that has passed through the separating main body part that is formed into an approximately cylindrical shape and communicates with the intake port flows with part of the air; and the fine dust air passage into which fine dust flows with the rest of the air, whereby it is possible to reduce the size of the separating section. In addition, the first filter is provided in the opening portion that is opened along the coarse dust air passage in the partition wall positioned between the coarse dust air passage and the fine dust air passage, whereby it is possible to ensure an increased area of the first filter while saving space.

[0011] Further, in accordance with the present invention, in the partition wall positioned between the main communication passage into which coarse dust separated in the separating section flows with part of the air and the auxiliary air passage into which fine dust flows with the rest of the air, there is opened the opening portion along the main communication passage, and the opening portion is provided with the first filter,

whereby it is possible to ensure an increased area of the first filter while saving space.

Brief Description of the Drawings

[0012] [Fig.1] A vertical cross-sectional view showing an electric vacuum cleaner according to an embodiment of the present invention;

[Fig.2] A front elevational view showing a part of the electric vacuum cleaner; and

[Fig.3] A perspective view showing the electric vacuum cleaner.

Reference Numerals

- [0013] 1: Electric vacuum cleaner
- 2: Vacuum cleaner main body
 - 3: Electric blower
 - 14: Intake port
 - 15: Exhaust port
 - 16: Separating section
 - 17: Separating main body part
 - 18: Auxiliary opening
 - 26: Partition wall
 - 31: Coarse dust air passage (main communication passage)
 - 32: Fine dust air passage (auxiliary air passage)
 - 34: Lower mesh filter as first filter

35: Communication port as opening portion

38: Pleat filter as second filter

Best Mode for Carrying Out the Invention

[0014] The configuration of an electric vacuum cleaner according to an embodiment of the present invention will hereinafter be described with reference to Figs.1 to 3.

[0015] In Figs.1 to 3, Numeral 1 denotes an electric vacuum cleaner. The electric vacuum cleaner 1 is a so-called upright-type, that is, stick-type vacuum cleaner. Also, the electric vacuum cleaner 1 includes a vacuum cleaner main body 2 having a vertically longitudinal shape, and an electric blower 3 is housed in a lower part of the vacuum cleaner main body 2, while a dust collecting section 4 is provided above the electric blower 3. Further, a hose body 5 is connected to an upper part on the rear side of the vacuum cleaner main body 2 to communicate with the upstream side, that is, suction side of the dust collecting section 4, and the leading end portion on the suction side of the hose body 5 is connected with a cylindrical connecting duct portion 6, a handheld duct portion 7, and an extension duct 8 in a communicating manner in this order. Furthermore, the leading end portion on the suction side of the extension duct 8 is inserted in the upper end portion, one end portion of a cylindrical attachment 9 that

is provided in a lower part on the rear side of the vacuum cleaner main body 2. Then, in the lower end portion, the other end portion of the attachment 9, there is inserted and connected the base end portion on the downstream side, that is, exhaust side of a floor brush 11 as an intake port body.

[0016] In the upper end portion of the vacuum cleaner main body 2, there is provided an arc-shaped handle part 12 to make it possible to carry the electric vacuum cleaner 1. Also, in an upper part on the rear side of the vacuum cleaner main body 2, there is provided an extension duct fixing part 13 for fixing the extension duct 8 thereto detachably. Further, in a rear part of the vacuum cleaner main body 2, there are bored a plurality of long outlet holes not shown in the figures to communicate with the exhaust side of the electric blower 3. Then, in a position of the vacuum cleaner main body 2 facing the rear part of the dust collecting section 4, there is formed an approximately circular intake port 14 in an opening manner. In the vacuum cleaner main body 2, there are also formed a plurality of Exhaust ports 15 in an opening manner below the intake port 14.

[0017] The intake port 14 communicates with the floor brush 11 so that air containing dust that is sucked through the floor brush 11 by driving the electric blower 3 passes

therethrough. Also, on the exhaust side of the intake port 14, there is provided a separating section 16.

[0018] Using inertia difference due to specific gravity or size, the separating section 16 is adapted to separate dust that is sucked therein through the floor brush 11 by driving the electric blower 3 to pass through the intake port 14 into coarse dust having a relatively large specific gravity or size and fine dust having a specific gravity or size smaller than that of the coarse dust, the section comprising an approximately straight cylindrical separating main body part 17 that is provided concentrically with the intake port 14. The separating main body part 17 protrudes into the dust collecting section 4 with the diameter thereof being reduced from the intake port 14 side toward the front side of the vacuum cleaner main body 2, that is, from the intake port 14 side toward the exhaust ports 15 side. In addition, on the periphery of the separating main body part 17, there are bored a plurality of auxiliary openings 18 that penetrate the separating main body part 17 in the radial direction.

[0019] The auxiliary openings 18 are separated from each other in the circumferential direction of the separating main body part 17 at approximately the same spacing. Also, mesh filters 18a are installed in the respective auxiliary openings

18 in such a manner as to cover the respective auxiliary openings 18.

[0020] The exhaust ports 15 are provided along the vertical direction of the vacuum cleaner main body 2 to have a long hole shape, and are separated from each other in the horizontal direction, that is, the width direction of the vacuum cleaner main body 2 at approximately the same spacing. Also, on the exhaust side of the exhaust ports 15, there is provided a communication air passage 19 that communicates with the suction side of the electric blower 3.

[0021] Then, the intake port 14 and the exhaust ports 15 are provided in approximately the same direction toward the separating section 16, as shown in Fig.2, to face the rear part of the dust collecting section 4.

[0022] The electric blower 3 is housed in the vacuum cleaner main body 2 with the suction side thereof facing upward. Also, the suction side of the electric blower 3 is connected airtightly to the dust collecting section 4 via the exhaust ports 15. Further, the electric blower 3 is driven with power to be supplied from an external power supply not shown in the figures via a power cord not shown in the figures that is wound unwindably and windably around a code reel 22 that is provided rotatably in the rear part of the vacuum cleaner main body 2.

[0023] The dust collecting section 4 is provided detachably to the vacuum cleaner main body 2. As shown in Fig.1, the dust collecting section 4 also includes: a hollow housing main body part 25; a partition wall 26 provided in the housing main body part 25; and an openable cover part 27 capable of opening and closing the housing main body part 25.

[0024] The housing main body part 25 communicates with the separating section 16, and is separated by the partition wall 26 into a coarse dust air passage (main communication passage) 31 on the front side and a fine dust air passage (auxiliary air passage) 32 on the rear side.

[0025] The coarse dust air passage 31 communicates with the downstream side of the separating main body part 17 of the separating section 16 via a vent hole 33 that is formed in the partition wall 26 in an opening manner concentrically with the separating main body part 17, and is bent downward with respect to the axial direction of the separating main body part 17 as well as being formed into a longitudinal shape along the vertical direction, that is, the longitudinal direction of the vacuum cleaner main body 2. Then, the coarse dust air passage 31 is adapted to flow coarse dust therein with part of the air that is sucked through the intake port 14, having a dust collecting function for mainly collecting the coarse dust in

a lower part thereof. Further, the downstream side of the coarse dust air passage 31 communicates with the fine dust air passage 32 via a communication port 35 as an opening portion with a lower mesh filter 34 as a first filter provided therein that is opened below the vent hole 33 in the partition wall 26.

[0026] Here, the lower mesh filter 34 is adapted to prevent coarse dust collected in the coarse dust air passage 31 from leaking through the communication port 35 for letting air that is flowed into the coarse dust air passage 31 to carry the coarse dust out of the coarse dust air passage 31.

[0027] Also, the communication port 35 is formed into a longitudinal shape along the coarse dust air passage 31.

[0028] Meanwhile, the fine dust air passage 32 communicates with the downstream side of the auxiliary openings 18 of the separating section 16, being formed into a vertically longitudinal shape in parallel with the coarse dust air passage 31 below the separating main body part 17. Then, the fine dust air passage 32 is adapted to flow minute dust that has passed through the mesh filters 18a in the auxiliary openings 18 thereinto with air that does not pass through the coarse dust air passage 31, that is, the rest of the air that is sucked through the intake port 14, housing a filter body 36 for

trapping the minute dust. Further, in a lower part on the rear side of the fine dust air passage 32, there is formed an exhaust communication port 37 communicating with the exhaust ports 15 in an opening manner.

[0029] The filter body 36 has a pleat filter 38 as a second filter and a frame body 39 for holding the periphery of the pleat filter 38 to be detachable within the fine dust air passage 32.

[0030] The pleat filter 38 is formed into a wave shape in an anteroposteriorly-curved manner, and a crease is formed in the vertical direction, that is, the direction along the fine dust air passage 32. Also, the pleat filter 38 is disposed in a position corresponding to that of the lower mesh filter 34 in the communication port 35 to face the rear side, that is, the downstream side of the lower mesh filter 34 so as to be perpendicular to the air flow from the coarse dust air passage 31. Further, the pleat filter 38 is formed larger than the lower mesh filter 34, when viewed from the front, to have a size corresponding to the entire communication port 35.

[0031] In addition, the frame body 39 is formed into a square frame shape to be installed in the fine dust air passage 32 in an inclined manner so that the upper side of the pleat filter 38 is positioned forward relative to the lower side

thereof. Further, the frame body 39 is provided with an inclined plate part 41 that is inclined downward from the rear side toward the front side thereof below the pleat filter 38. The front end portion, that is, the leading end portion of the inclined plate part 41 is positioned in a lower part of the fine dust air passage 32 to continue to a minute dust collecting section 42 that is provided in the openable cover part 27. The minute dust collecting section 42, which is adapted to collect minute dust that has been trapped in the pleat filter 38 and fallen down the inclined plate part 41, can be opened and closed by opening and closing the openable cover part 27.

[0032] Then, in a rear part of the filter body 36, there is provided dusting means 43 for removing, that is, shaking off minute dust that is trapped in the pleat filter 38. The dusting means 43 is adapted to shake off minute dust that is trapped in the pleat filter 38 to be made to fall down into the minute dust collecting section 42 by, for example, driving a motor not shown in the figures in a rotating manner to vibrate the pleat filter 38.

[0033] Further, the exhaust communication port 37 faces and communicates with the exhaust ports 15. The exhaust communication port 37 is adapted to let sucked air out through the rear part of the fine dust air passage 32 toward the exhaust

ports 15. Thus, the filter body 36 communicates with the suction side of the electric blower 3 via the exhaust communication port 37 and the exhaust ports 15. A lower filter not shown in the figures is further installed in the exhaust communication port 37 in such a manner as to cover the entire exhaust communication port 37.

[0034] Also, the partition wall 26 is positioned between the coarse dust air passage 31 and the fine dust air passage 32, having a surface direction along the horizontal direction intersecting with the anteroposterior direction of the electric vacuum cleaner 1, and is formed into a vertically longitudinal shape as well as continues from the upper end portion in the housing main body part 25 through the openable cover part 27. Further, the communication port 35 provided in the partition wall 26 is separated downward from the vent hole 33 and is opened to be a longitudinal shape from a position above the vertically central region of the partition wall 26 through the vicinity of the lower end portion of the partition wall 26. Then, the lower mesh filter 34 provided in the communication port 35 is disposed in a grid pattern across the entire communication port 35.

[0035] In addition, the openable cover part 27 is provided vertically rotatably in a rear part of the lower end portion

of the housing main body part 25. Further, the openable cover part 27 can be opened and closed with respect to the housing main body part 25 by operating a cover part clamp not shown in the figures.

[0036] As shown in Fig.3, the hose body 5 has an elongated accordion-type cylindrical shape made of, for example, flexible synthetic resin to be made stretchable in the axial direction thereof.

[0037] The connecting duct portion 6 is formed into a cylindrical shape made of, for example, synthetic resin harder than the hose body 5, and is provided concentrically with the hose body 5 to communicate with the leading end portion of the hose body 5. The connecting duct portion 6 is also connected detachably to the base end portion on the exhaust side of the handheld duct portion 7 in a communicating manner.

[0038] The handheld duct portion 7 includes: an approximately cylindrical main body part 46 that communicates with the leading end portion on the suction side of the connecting duct portion 6 and the base end portion on the exhaust side of the extension duct 8; and a holding part 47 protruding radially from the main body part 46. The holding part 47 protrudes from the outside surface on the leading end side of the main body part 46 to be bent toward the base end

side of the main body part 46. The holding part 47 is also provided with a plurality of setup buttons not shown in the figures for driving the electric blower 3 in a predetermined driving mode.

[0039] The extension duct 8 is adapted to function as an arm when an operator operates the electric vacuum cleaner 1, being formed into an elongated cylindrical shape, that is, a longitudinal shape made of metal such as aluminum. The extension duct 8 communicates with the suction side of the electric blower 3 via the handheld duct portion 7, the connecting duct portion 6, the hose body 5, and the dust collecting section 4.

[0040] Then, a packing 79 is installed in the attachment 9 so that the leading end portion of the extension duct 8 and the base end portion of the floor brush 11 are inserted detachably into a communication duct 82, respectively, from above and below to be connected airtightly.

[0041] As shown in Figs.1 and 3, the floor brush 11 is placed on a floor surface as a to-be-cleaned surface to support the electric vacuum cleaner 1, communicating with the leading end portion on the suction side of the extension duct 8 through the attachment 9 with the extension duct 8 being inserted in the upper end portion of the attachment 9.

[0042] The floor brush 11 also includes a hollow horizontally-long case body 81 with a suction port 81a being formed in a lower part thereof facing the floor surface in an opening manner. On a rear part of the case body 81, there is rotatably provided the cylindrical communication duct 82 in a protruding manner to communicate with the suction port 81a, and the communication duct 82 is inserted into the lower end portion of the attachment 9 to be connected airtightly.

[0043] Here, the communication duct 82 is arranged detachably against the attachment 9 using a brush clamp 83 provided in a rear part of the attachment 9. Also, the communication duct 82 is in contact airtightly with the packing 79.

[0044] Further, on either side of the communication duct 82 of the floor brush 11, there are provided brush following wheels 84 rotatably. The electric vacuum cleaner 1 can travel on the floor surface forward and backward using the brush following wheels 84.

[0045] Next will be described a cleaning operation according to the above-described embodiment.

[0046] In a normal cleaning operation, the power cord is plugged into a socket not shown in the figures with the extension duct 8 being attached to the vacuum cleaner main body

2, and the holding part 47 of the handheld duct portion 7 is held to operate a predetermined setup button to drive the electric blower 3.

[0047] Then, the operator holds the holding part 47 to allow the electric vacuum cleaner 1 to travel forward and backward and suck dust through the suction port 81a of the floor brush 11 to clean the floor surface.

[0048] Also, when cleaning a narrow space such as a door rail where the width of the floor brush 11 cannot enter, the extension duct 8 is detached from the vacuum cleaner main body 2 to suck dust through the leading end portion of the extension duct 8.

[0049] Further, in a cleaning operation on a desk, etc., the connecting duct portion 6 is detached from the handheld duct portion 7 to suck dust through the leading end portion of the connecting duct portion 6.

[0050] Air sucked with dust passes through the intake port 14 and the vent hole 33 through the hose body 5 as sucked air to subsequently flow into the separating section 16.

[0051] The sucked air is then restricted through the separating main body part 17 to increase the flow rate thereof, and coarse dust among the dust contained in the sucked air having a relatively large specific gravity or size passes

through the separating main body part 17 straightforward with sucked air W1 to flow into the coarse dust air passage 31, while fine dust having a relatively small specific gravity or size is separated in the circumferential direction of the separating main body part 17 to flow into the auxiliary openings 18 to be trapped partially in the mesh filters 18a. Minute dust that has passed through the mesh filters 18a then flows into the fine dust air passage 32 with sucked air W2.

[0052] The coarse dust flowing into the coarse dust air passage 31 is trapped when the sucked air W1 flowing into the coarse dust air passage 31 passes through the lower mesh filter 34 to be collected in the coarse dust air passage 31. Then, the sucked air W1 with the coarse dust being removed passes through the pleat filter 38 to subsequently flow from the exhaust ports 15 into the communication air passage 19 through the exhaust communication port 37 and then flow toward the suction side of the electric blower 3.

[0053] Meanwhile, the minute dust flowing into the fine dust air passage 32 is to be trapped in the pleat filter 38 when the sucked air W2 flows through the pleat filter 38 vertically. Then, the sucked air W2 with the minute dust being removed flows from the exhaust ports 15 into the communication air passage 19 through the exhaust communication port 37 to

flow toward the suction side of the electric blower 3.

[0054] The sucked air flowing into the electric blower 3 then passes through the electric blower 3 to be exhausted from the vacuum cleaner main body 2 through an outlet hole as outlet air.

[0055] Also, after the cleaning operation, etc., the dusting means 43 is to be driven by the motor not shown in the figures so that the minute dust trapped in the pleat filter 38 is shaken off from the pleat filter 38 and then collected in the minute dust collecting section 42 through the inclined plate part 41.

[0056] Further, the dust collected in the coarse dust air passage 31 and the minute dust collecting section 42 is to be put into a trash, etc., not shown in the figures provided outside the dust collecting section 4 by detaching the dust collecting section 4 from the vacuum cleaner main body 2 with the electric blower 3 being stopped and operating the cover part clamp to open the openable cover part 27.

[0057] The dust collecting section 4 is subsequently attached to the vacuum cleaner main body 2 again to be used.

[0058] As mentioned above, in the above-described embodiment, it is arranged that in the partition wall 26 positioned between the coarse dust air passage 31 through which

coarse dust separated in the separating section 16 passes with sucked air W1 and the fine dust air passage 32 through which minute dust separated in the separating section 16 passes with residual sucked air W2, there is formed the communication port 35, which is adapted to let the sucked air W1 flowing into the coarse dust air passage 31 out of the coarse dust air passage 31, along the coarse dust air passage 31 in an opening manner, and that the communication port 35 is provided with the lower mesh filter 34 for preventing dust collected in the coarse dust air passage 31 from leaking from the coarse dust air passage 31.

[0059] It is consequently possible to ensure an increased area of the lower mesh filter 34 easily while saving space without increasing the cross-sectional area of the coarse dust air passage 31 or the size of the vacuum cleaner main body 2, etc., relative to the case where a lower mesh filter is formed along, for example, a direction intersecting with the coarse dust air passage 31.

[0060] Particularly, in the above-described embodiment, since the separating section 16 includes the approximately straight cylindrical separating main body part 17 and the auxiliary openings 18 bored on the periphery of the separating main body part 17 to separate dust contained in sucked air

straightforward, it is possible to further reduce the size of the separating section 16 and the electric vacuum cleaner 1 relative to the case where a cyclone separating section for swirling sucked air to centrifuge dust is used, for example.

[0061] In addition, since the coarse dust air passage 31 has the dust collecting function for collecting dust that passes therethrough, it is possible to reduce the size of the vacuum cleaner main body 2 relative to the case where a dust collecting section is provided separately from the coarse dust air passage 31.

[0062] Further, since the air passages 31 and 32 run vertically parallel with each other and the coarse dust air passage 31 has the dust collecting function in a lower part thereof, dust flowing into the air passages 31 and 32 falls down by its own weight to accumulate easily in the bottom of the housing main body part 25, resulting in an easy separation between sucked air and dust.

[0063] Then, since the pleat filter 38 is provided along the fine dust air passage 32 in a position corresponding to that of the lower mesh filter 34, the resistance in the air passages is increased due to the filters 34 and 38, resulting in an improvement in dust collecting performance and a lower possibility of clogging the filters 34 and 38.

[0064] Also, since the pleat filter 38 has a pleat shape with a crease formed therein along the fine dust air passage 32, it is possible to ensure an increased surface area of the pleat filter 38 through which sucked air W2 passes, resulting in an improvement in dust collecting efficiency.

[0065] Furthermore, since the intake port 14 and the exhaust ports 15 are positioned facing the rear part of the dust collecting section 4 on the same side of the housing main body part 25, it is only required to provide a seal packing, etc., in a rear part of the dust collecting section 4 when attaching the dust collecting section 4 to the vacuum cleaner main body 2, resulting in an improvement in sealing performance relative to the case where seal packing, etc., is provided in both front and rear parts of the dust collecting section 4, for example.

[0066] Then, since the pleat filter 38 is inclined downward toward the front side and the inclined plate part 41 continuing to the upper part of the minute dust collecting section 42 is provided below the pleat filter 38, it is possible to collect minute dust shaken off from the pleat filter 38 when the dusting means 43 is driven in the minute dust collecting section 42 reliably.

[0067] Also, applying the foregoing dust collecting

section 4 to an upright-type electric vacuum cleaner allows the configuration of the vacuum cleaner main body 2 having a vertically longitudinal shape to be utilized effectively to prevent the size of the vacuum cleaner main body 2 from increasing.

[0068] It is noted in the above-described embodiment that the separating section 16 is not restricted to the above-described configuration as long as it is capable of separating dust in accordance with the specific gravity or size thereof.

[0069] Similarly, the details of the electric vacuum cleaner 1 are not restricted to the above-described configuration.

[0070] Then, the electric vacuum cleaner 1 can be applied correspondingly to not only a stick-type one but also a so-called canister-type one, etc.

Industrial Applicability

[0071] The present invention is preferably utilized for, for example, an upright-type electric vacuum cleaner.